WHAT IS CLAIMED IS:

1. A leak detector of liquid in a tank, comprising:

a measuring slim-tube into/from which the liquid in the tank is introduced or discharged through the lower end thereof;

a measuring tube connected to the upper end of the measuring slim-tube and having a sectional area larger than that thereof;

a sensor section additionally provided to the measuring slim-tube and including a first temperature sensor, a heater and a second temperature sensor arranged in this order along the measuring slim-tube, the sensor section measuring the flow rate of the liquid in the measuring slim-tube; and

a leak detection control unit connected to the sensor section,

wherein the leak detection control unit has a pulse voltage generating circuit for applying a single pulse voltage to the heater and a leak detecting circuit connected to the first and second temperature sensors and generating an output corresponding to a difference between temperatures detected by the first and second temperature sensors, and

wherein the leak detection control unit integrates a difference between an output of the leak detecting circuit and its initial value in response to the application of the single pulse voltage to the heater which is performed by the pulse voltage generating circuit to calculate a value equivalent to the flow rate of the liquid to thereby detect leakage of the liquid in the tank based on the calculated value.

2. The leak detector as claimed in claim 1, wherein the single pulse voltage has a pulse width of 2 to 10 seconds, and the value equivalent to the flow rate of the liquid is a value obtained by integrating the output of the leak detecting circuit for 20 to 150 seconds.

3. The leak detector as claimed in claim 2, wherein the pulse voltage generating circuit applies the single pulse voltage to the heater at a time interval of 40 seconds to 5 minutes, provided that the time interval is larger than integration time period during which the difference between the output of the leak detecting circuit and its initial value is integrated.

4. The leak detector as claimed in claim 1, wherein the leak detection control unit issues a leakage detection signal when the value equivalent to the flow rate of the liquid falls within a predetermined range.

5. The leak detector as claimed in claim 1, wherein a circuit container is attached to the upper portion of the measuring tube, and the leak detection control unit is provided in the circuit container.

6. The leak detector as claimed in claim 1, wherein each of the first and second temperature sensors has a first heat transfer member brought into contact with the outer surface of the measuring slim-tube and a temperature sensitive element

coupled to the first heat transfer member, and the heater has a second heat transfer member brought into contact with the outer surface of the measuring slim-tube and a heating element coupled to the second heat transfer member.

7. A leak detector of liquid in a tank, comprising:

a measuring slim-tube into/from which the liquid in the tank is introduced or discharged through the lower end thereof;

a measuring tube connected to the upper end of the measuring slim-tube and having a sectional area larger than that thereof;

a flow rate sensor section additionally provided to the measuring slim-tube and including a first temperature sensor, a heater and a second temperature sensor arranged in this order along the measuring slim-tube, the flow rate sensor section measuring the flow rate of the liquid in the measuring slim-tube;

a pressure sensor for measuring the level of the liquid; and

a leak detection control unit connected to the flow rate sensor section and pressure sensor,

wherein the leak detection control unit has a voltage generating circuit for applying a voltage to the heater and a leak detecting circuit connected to the first and second temperature sensors and generating an output corresponding to a difference between temperatures detected by the first and second temperature sensors,

wherein the leak detection control unit performs a first

leakage detection that detects leakage of the liquid in the tank based on the value equivalent to the flow rate of the liquid which is calculated using an output of the leak detecting circuit and a second leakage detection that detects leakage of the liquid in the tank based on the magnitude of a variation rate with respect to time of the level of liquid which is measured by the pressure sensor, and

wherein the leak detection control unit outputs a result of the second leakage detection in the case where the magnitude of the liquid level variation rate with respect to time falls within a predetermined range in the second leakage detection, outputs a result of the first leakage detection in the case where the magnitude of the liquid level variation rate with respect to time falls below the lower limit of the predetermined range in the second leakage detection, and stops the output of a leakage detection signal in the case where the magnitude of the liquid level variation rate with respect to time falls above the upper limit of the predetermined range in the second leakage detection.

8. The leak detector as claimed in claim 7, wherein the leak detection control unit stops the first leakage detection for a predetermined time length in the case where the magnitude of the liquid level variation rate with respect to time falls above the upper limit of the predetermined range in the second leakage detection.

9. The leak detector as claimed in claim 8, wherein the leak detection control unit stops operations of the voltage

generating circuit and leak detecting circuit for the predetermined time length in the case where the magnitude of the liquid level variation rate with respect to time falls above the upper limit of the predetermined range in the second leakage detection.

10. The leak detector as claimed in claim 7, wherein the voltage generating circuit is a pulse voltage generating circuit that applies a single pulse voltage to the heater, and the leak detection control unit integrates a difference between an output of the leak detecting circuit and its initial value in response to the application of the single pulse voltage to the heater which is performed by the pulse voltage generating circuit to calculate the value equivalent to the flow rate of the liquid to thereby detect leakage of the liquid in the tank based on the calculated value.

11. The leak detector as claimed in claim 10, wherein the single pulse voltage has a pulse width of 2 to 10 seconds, and the value equivalent to the flow rate of the liquid is a value obtained by integrating the output of the leak detecting circuit for 20 to 150 seconds.

12. The leak detector as claimed in claim 11, wherein the pulse voltage generating circuit applies the single pulse voltage to the heater at a time interval of 40 seconds to 5 minutes, provided that the time interval is larger than integration time period during which the difference between the output of the leak detecting circuit and its initial value

is integrated.

13. The leak detector as claimed in claim 7, wherein the voltage generating circuit is a constant voltage generating circuit that applies a constant voltage to the heater.

14. The leak detector as claimed in claim 7, wherein the leak detection control unit calculates the liquid level variation rate with respect to time at a time interval of 2 to 10 seconds.

15. The leak detector as claimed in claim 7, wherein a circuit container is attached to the upper portion of the measuring tube, and the leak detection control unit is provided in the circuit container.

16. The leak detector as claimed in claim 7, wherein the pressure sensor is disposed near the lower end of the measuring slim-tube.

17. The leak detector as claimed in claim 7, wherein each of the first and second temperature sensors has a first heat transfer member brought into contact with the outer surface of the measuring slim-tube and a temperature sensitive element coupled to the first heat transfer member, and the heater has a second heat transfer member brought into contact with the outer surface of the measuring slim-tube and a heating element coupled to the second heat transfer member.

18. A leak detector of liquid in a tank, comprising:

a measuring slim-tube into/from which the liquid in the tank is introduced or discharged through the lower end thereof;

a measuring tube connected to the upper end of the measuring slim-tube and having a sectional area larger than that thereof;

a flow rate sensor section additionally provided to the measuring slim-tube and including a first temperature sensor, a heater and a second temperature sensor arranged in this order along the measuring slim-tube, the flow rate sensor section measuring the flow rate of the liquid in the measuring slim-tube;

a pressure sensor for measuring the level of the liquid; and

a leak detection control unit connected to the flow rate sensor section and pressure sensor,

wherein the leak detection control unit has a voltage generating circuit for applying a voltage to the heater, a leak detecting circuit connected to the first and second temperature sensors and generating an output corresponding to a difference between temperatures detected by the first and second temperature sensors, and an on-off valve provided in the upper portion of the measuring tube, and

wherein the leak detection control unit detects the specific gravity of the liquid in the tank based on a value equivalent to the flow rate of the liquid which is calculated by using the output of the leak detecting circuit in a state where the on-off valve is closed, measures the level of the

liquid by means of the pressure sensor by using the value of the specific gravity detected in the above to thereby perform a leakage detection of the liquid in the tank based on the magnitude of a variation rate of the level of the liquid with respect to time.

19. The leak detector as claimed in claim 18, wherein the leak detection control unit detects the specific gravity of the liquid a plurality of times to thereby obtain a plurality of specific gravity values, and measures the level of the liquid by using an average value of the plurality of specific gravity values as the value of the specific gravity.

20. The leak detector as claimed in claim 18, wherein the leak detection control unit uses the obtained value of the specific gravity to measure the level of the liquid only when the value of the specific gravity falls within a certain range defined for liquid of a predetermined kind and performs error processing when the obtained value of the specific gravity falls outside the certain range.

21. The leak detector as claimed in claim 18, further comprising a third temperature sensor for measuring the temperature of the liquid,

wherein the leak detection control unit is connected to the third temperature sensor, and

wherein the leak detection control unit uses a calibration curve of specific gravity at reference temperature to obtain a specific gravity value when detecting the specific

gravity, converts the specific gravity value into the value of the specific gravity at an the temperature of the liquid which is measured by the third temperature sensor, and uses the obtained value of the specific gravity to measure the level of the liquid.

22. The leak detector as claimed in claim 18, wherein the leak detection control unit further performs minute leakage detection that detects leakage of the liquid in the tank based on the value equivalent to the flow rate of the liquid which is calculated using the output of the leak detecting circuit in a state where the on-off valve is opened, and

wherein the leak detection control unit outputs a result of the leakage detection in the case where the magnitude of the liquid level variation rate with respect to time falls within a predetermined range in the leakage detection, outputs a result of the minute leakage detection in the case where the magnitude of the liquid level variation rate with respect to time falls below the lower limit of the predetermined range in the leakage detection, and stops the output of a leakage detection signal in the case where the magnitude of the liquid level variation rate with respect to time falls above the upper limit of the predetermined range in the leakage detection.

23. The leak detector as claimed in claim 22, wherein the leak detection control unit stops the minute leakage detection for a predetermined time length in the case where the magnitude of the liquid level variation rate with respect to

time falls above the upper limit of the predetermined range in the leakage detection.

24. The leak detector as claimed in claim 23, wherein the leak detection control unit stops operations of the voltage generating circuit and leak detecting circuit for the predetermined time length in the case where the magnitude of the liquid level variation rate with respect to time falls above the upper limit of the predetermined range in the leakage detection.

25. The leak detector as claimed in claim 18, wherein the voltage generating circuit is a pulse voltage generating circuit that applies a single pulse voltage to the heater, and the leak detection control unit integrates a difference between an output of the leak detecting circuit and its initial value in response to the application of the single pulse voltage to the heater which is performed by the pulse voltage generating circuit to calculate the value equivalent to the flow rate of the liquid.

26. The leak detector as claimed in claim 25, wherein the single pulse voltage has a pulse width of 2 to 10 seconds, and the value equivalent to the flow rate of the liquid is a value obtained by integrating the output of the leak detecting circuit for 20 to 150 seconds.

27. The leak detector as claimed in claim 26, wherein the pulse voltage generating circuit applies the single pulse

voltage to the heater at a time interval of 40 seconds to 5 minutes, provided that the time interval is larger than integration time period during which the difference between the output of the leak detecting circuit and its initial value is integrated.

28. The leak detector as claimed in claim 18, wherein the leak detection control unit calculates the liquid level variation rate with respect to time at a time interval of 2 to 10 seconds.

29. The leak detector as claimed in claim 18, wherein a circuit container is attached to the upper portion of the measuring tube, and the leak detection control unit is provided in the circuit container.

30. The leak detector as claimed in claim 18, wherein the pressure sensor is disposed near the lower end of the measuring slim-tube.

31. The leak detector as claimed in claim 18, wherein each of the first and second temperature sensors has a first heat transfer member brought into contact with the outer surface of the measuring slim-tube and a temperature sensitive element coupled to the first heat transfer member, and the heater has a second heat transfer member brought into contact with the outer surface of the measuring slim-tube and a heating element coupled to the second heat transfer member.